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Two-Dimensional Electron Gases at Modulation-doped Oxide Interfaces

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Two-dimensional electron gases (2DEGs) formed at the interface of insulating complex oxides promise the development of all-oxide electronic devices. However, despite of intensive research, it remains a major challenge to increase the mobility of the 2DEG or to order the property on demand. Based on our recent discovery of extreme mobility enhancement at LaMnO₃-buffered LaAlO₃/SrTiO₃ (LAO/STO) interface [1], we herein explored three different ways to include LaMnO₃ into the polar LAO/STO interfaces. Particularly, I will present tunable phase diagram of the LAO/STO interface, which shows a Lifshitz transition at a density of $2.8 \times 10^{13} \text{cm}^{-2}$, enhanced spin-orbital coupling as well as the consistence of ferromagnetic 2DEG and interface superconductivity [2]. LaMnO₃ modulation doping provides much richer phenomena to the LAO/STO system.

[1] Y. Z. Chen *et al.* *Nature Mater.* **14**, 801 (2015)

[2] Y. L. Gan, Y. Z. Chen *et al.* (*To be submitted*).